SCIENCE ON VIEW

"ENVISIONING SCIENCE: THE DESIGN AND CRAFT OF THE SCIENCE IMAGE," *by Felice Frankel, MIT Press, 2002, 328 pages, $55 (ISBN 0-262-06225-9)*

REVIEWED BY JOHN D. ROBERTS

FIFTY YEARS AGO, BEFORE WHAT might be regarded as the modern age of publishing, scientific books and journals looked very much as they had 100 years earlier. To be sure, they were published in many languages, but all the printing was in one color—black; covers were drab; there were few half-tone photographs; and chemical formulas were awkwardly drawn, with geometries dictated by the limitations of manual typesetting.

No longer. Advances in making printing plates, less expensive color printing, drawing programs such as Illustrator and ChemDraw, and software tools such as Photoshop to manipulate photographs have changed books and journals to true objects of graphic art. Now these publications use striking visual effects to vie with each other to attract our attention. Scientists compete avidly to provide striking illustrations that they hope will turn their research advances into "cover stories" in what might be fairly described as the weekly newsmagazines of the scientific disciplines. Other scientists would like to compete in these ball games or, at least, be able to improve their skills in graphic arts, whether in print or in slide presentations.

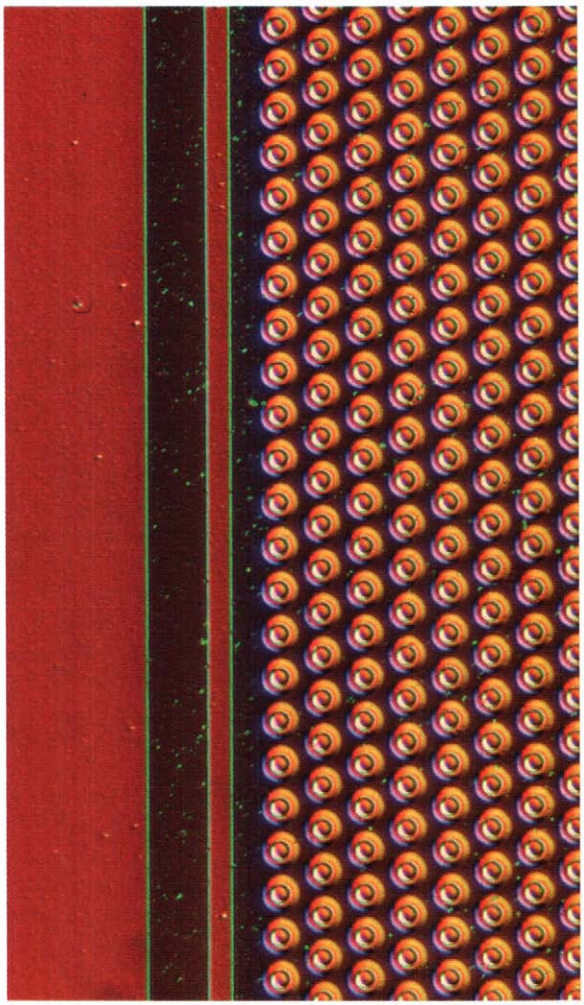
If this is your desire and you use photography, "Envisioning Science: The Design and Craft of the Science Image" is meant for you. It was written by Felice Frankel, research scientist in electrical engineering and computer science at Massachusetts Institute of Technology. Frankel is a leader in using photography to produce evocative journal covers. She also coauthored with Harvard chemist George M. Whitesides the truly innovative 1997 book "On the Surface of Things," which blends graphic art with solid science (C&EN, March 9, 1998, page 50).

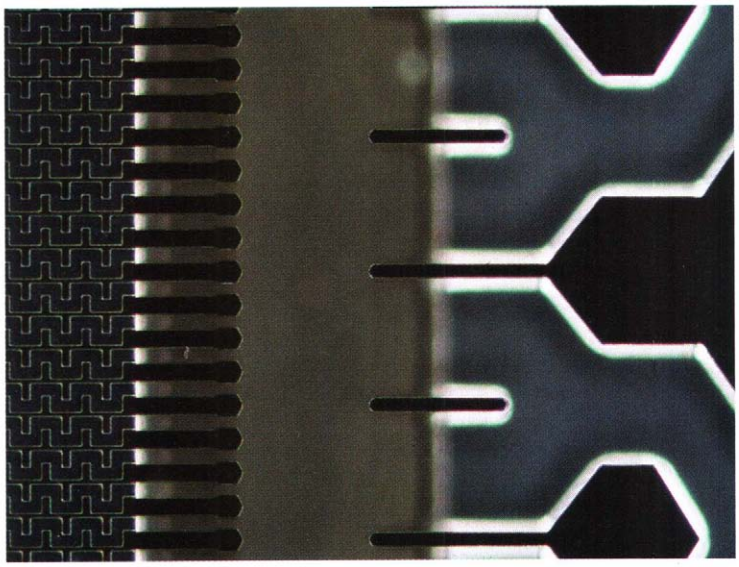
You have to meet and talk with Frankel to really sense her intense enthusiasm, almost obsession, for improving science illustration. That was clearly evident in June 2001, when I attended a very successful several-day conference she organized at MIT called "Image and Meaning: Envisioning and Communicating Science and Technology." Participants came from an incredible range of disciplines: school teachers, journalists, software engineers, astronomers, chemists, biologists, photographers, and more. The conference dealt primarily with images, rather than with techniques, and the present volume goes far beyond that by explaining the magical secrets that underlie Frankel's art.

I approach this book not as an artist, but as a chemist with some experience in graphics. I have been a photographer since age 10, and, in 1959, with the aid of my early and very innovative publisher, W. A. Benjamin, I produced what was probably the first advanced chemistry book to use four-color printing. In 1961, I developed an early example of desktop publishing.

Frankel's book is primarily about photography, although her suggestions about composition, fonts, and colors apply well to other forms of graphical representation. The book is designed to be an actual laboratory manual, with fairly detailed directions, specific exercises to be carried out, and suggestions for rather difficult self-evaluations of the results. The photographs are exemplary, the selections are very diverse, and the explanations are clear and cover the use of several kinds of instrumentation. Of special interest to many chemists will be her discussion of scanning electron microscopy and related techniques. She also provides short but worthwhile discussions of the benefits of film versus digital cameras, choices of resolution, and scanning images.

Frankel also devotes considerable attention to the vexing and very important question of how far it is appropriate and ethical





MICROORDER **Microreactors from Klavs Jensen's lab at MIT, above and left, become works of art.**

to modify raw photographic data. She suggests that journals adopt strict policies to ensure that readers know exactly how much photographic illustrations have been "improved" by software or other means.

I have problems with the book's layout. The typeface seems unnecessarily small, but this may have been done to provide space for user annotations. The volume is tall and thick, rather than wide and thin. And it won't consistently lie open on a tabletop, as a laboratory manual should.

Some chemists may wonder how useful a book that deals primarily with photography will be for them. Understandably, it offers no advice on how to depict single molecules, most of which are too small to be photographed. It does include macromolecular assemblies of molecules, however. Such assemblies are now the stuff of a large fraction of the illustrations in C&EN, *Science, Nature,* and the like. Many useful and diverse software packages for molecular representations do exist; perhaps someone could write a book analogous to Frankel's, explaining how best to use these competing packages.

Frankel discusses the crucial matter of how to present visual material effectively in both public and professional lectures. Here, she and I must agree to disagree. Frankel believes that photographs or graphics are the important elements, so text should be minimal and nonintrusive. The lecturer's role is to explain what the graphics are all about, with little aid from text on the slides.

The success of this approach will depend greatly on the verbal skills of the lecturer, the difficulty of the subject, and how each individual auditor best absorbs knowledge. At the pace of a chalk talk, I can absorb spoken information rather well. But at the firehose pace of the usual slide or PowerPoint presentation, this can be difficult.

Most scientists do put text on their slides. Usually it can be read in just a few seconds, giving a reasonable idea of what the matter at hand is all about. Then one can try to consolidate one's understanding by hearing what the lecturer says, which is usually not a verbatim recitation of the text on the slide. Even if it is, though, having the lecturer speak the information will slow down the flow of new material and give the audience a chance to digest it.

Those interested in learning to make elegant, informative, and artistic scientific photographs will find that "Envisioning Science" is a very useful text. Like "On the Surface of Things," the book itself is a wonderfully inspiring exposition of the beauty of science.

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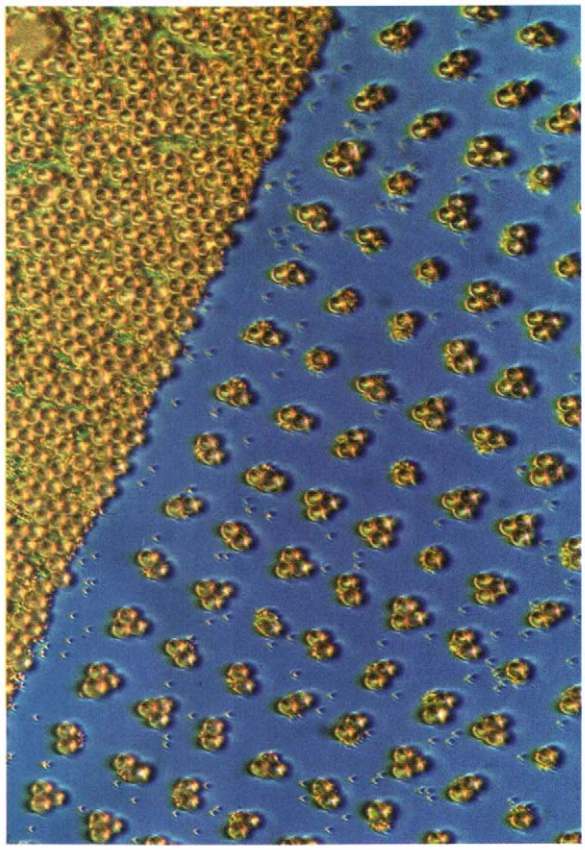

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ORGANIZED Negatively charged colloids self-assemble on a patterned polyelectrolyte surface.

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